YEAR ROUND REMOTE SENSING IN MINNESOTA'S SENTINEL LAKES 10 YEARS OF LESSONS LEARNED

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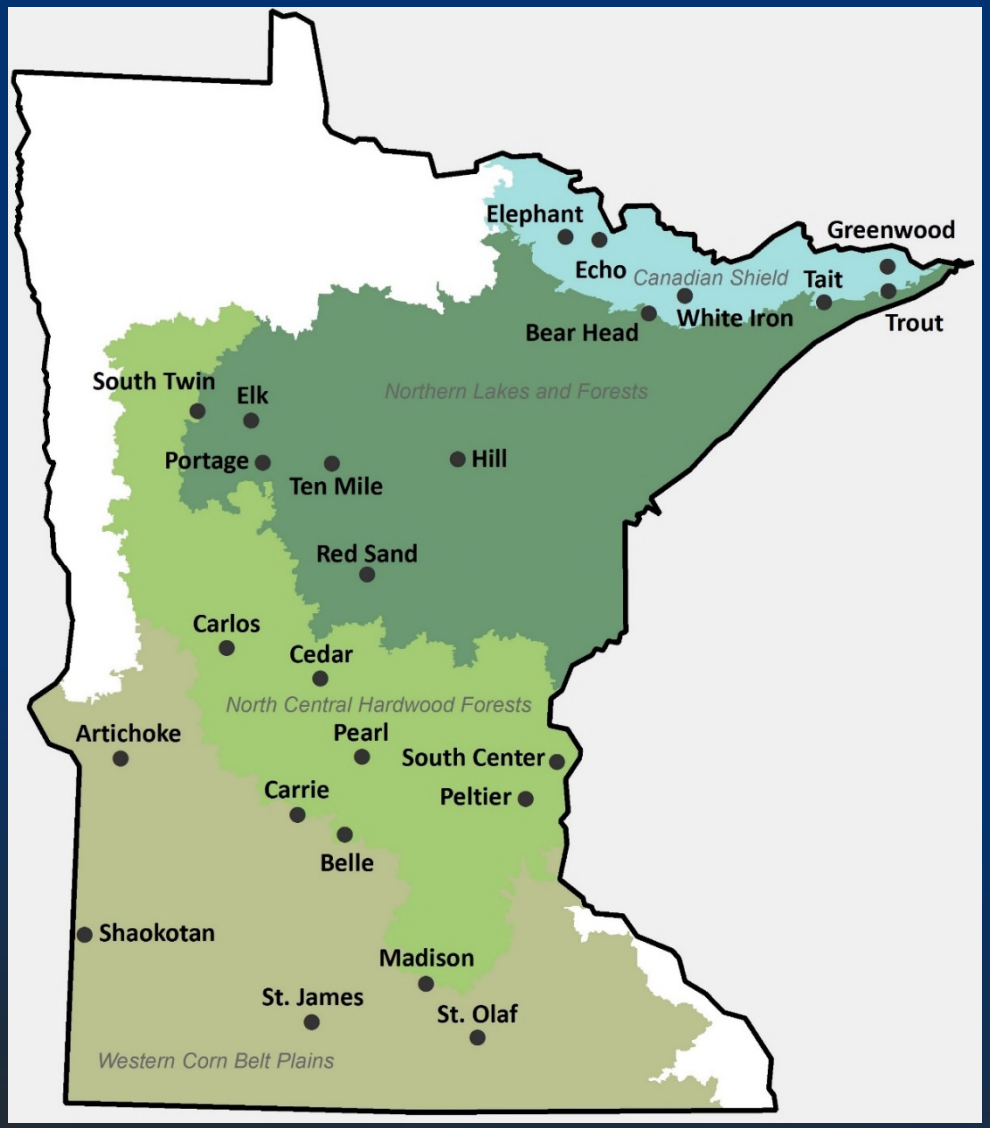
MINNESOTA'S SENTINEL LAKES



SENTINEL LAKES MONITORING

- Water chemistry
- Remote sensing
  - Cont. water temp., D.O. and lake level
  - Nested wells (ground/surface water)
- Primary Producers
  - Phytoplankton
  - Macrophytes
- Zooplankton
- Fisheries
  - Littoral fish (Fish IBI)
  - Juvenile fish (spring and fall EF)
  - Pelagic Fish (vertical gillnets and hydroacoustic)
- Collaborative Program
  - MDNR, MPCA, and external cooperators

SENTINEL LAKES SENSOR ARRAYS

- Temperature Monitoring
  - 25 Lakes
  - Over 180 loggers deployed
- Dissolved Oxygen
  - 8 Lakes
  - In total, > 100 cont. DO sensors
- Water Level Monitoring
  - 9 lakes
  - Other lakes use staff gauges
  - 4 lakes nested GW wells

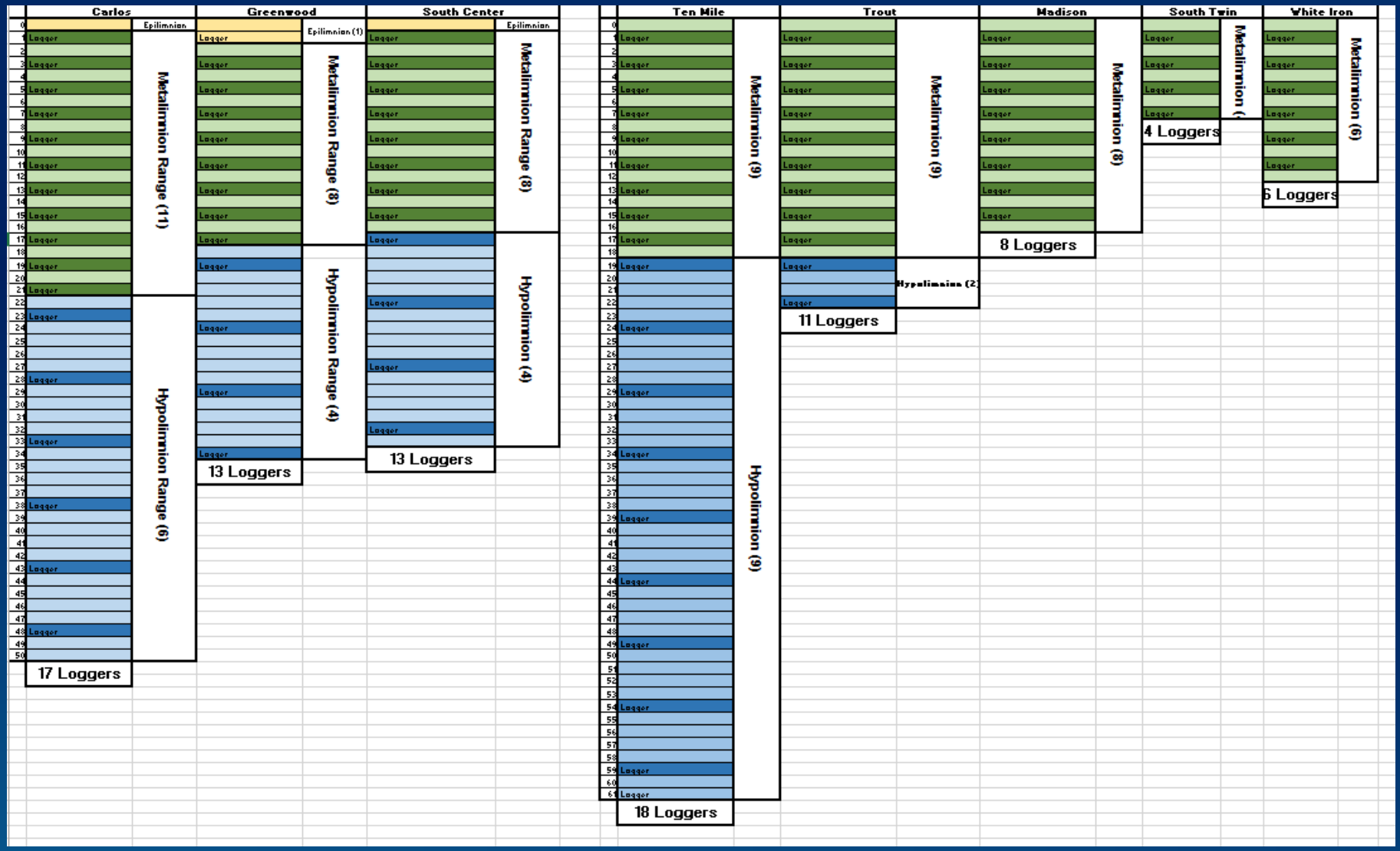
SENSOR ARRAYS START UP COST

- Temperature Monitoring
  - $100 per sensor
- Dissolved Oxygen
  - $1000 per sensor
- Funding provided by grants, gifts, state monitoring budgets
  - MDNR long term monitoring budget
  - Glacial Lakes Fish Habitat Partnership Grant
  - USFWS gifted loggers

TEMPERATURE CHAIN EXAMPLE

Carlos Temperature Sensor Chain					
0		**Epilimnion**	22		**Hypolimnion (loggers placed at geometrically increasing intervals down to the bottom)**
1	Logger	**Metalimnion (loggers placed at 1 meter intervals)**	**23**	Logger	
2			24		
3	Logger		25		
4			**26**	Logger	
5	Logger		27		
6			28		
7	Logger		29		
8			**30**	Logger	
9	Logger		31		
10			32		
11	Logger		33		
12			34		
13	Logger		**35**	Logger	
14			36		
15	Logger		37		
16			38		
17	Logger		39		
18			40		
19	Logger		**41**	Logger	
20			42		
21	Logger		43		
			44		
			45		
			46		
			47		
			48	Logger	

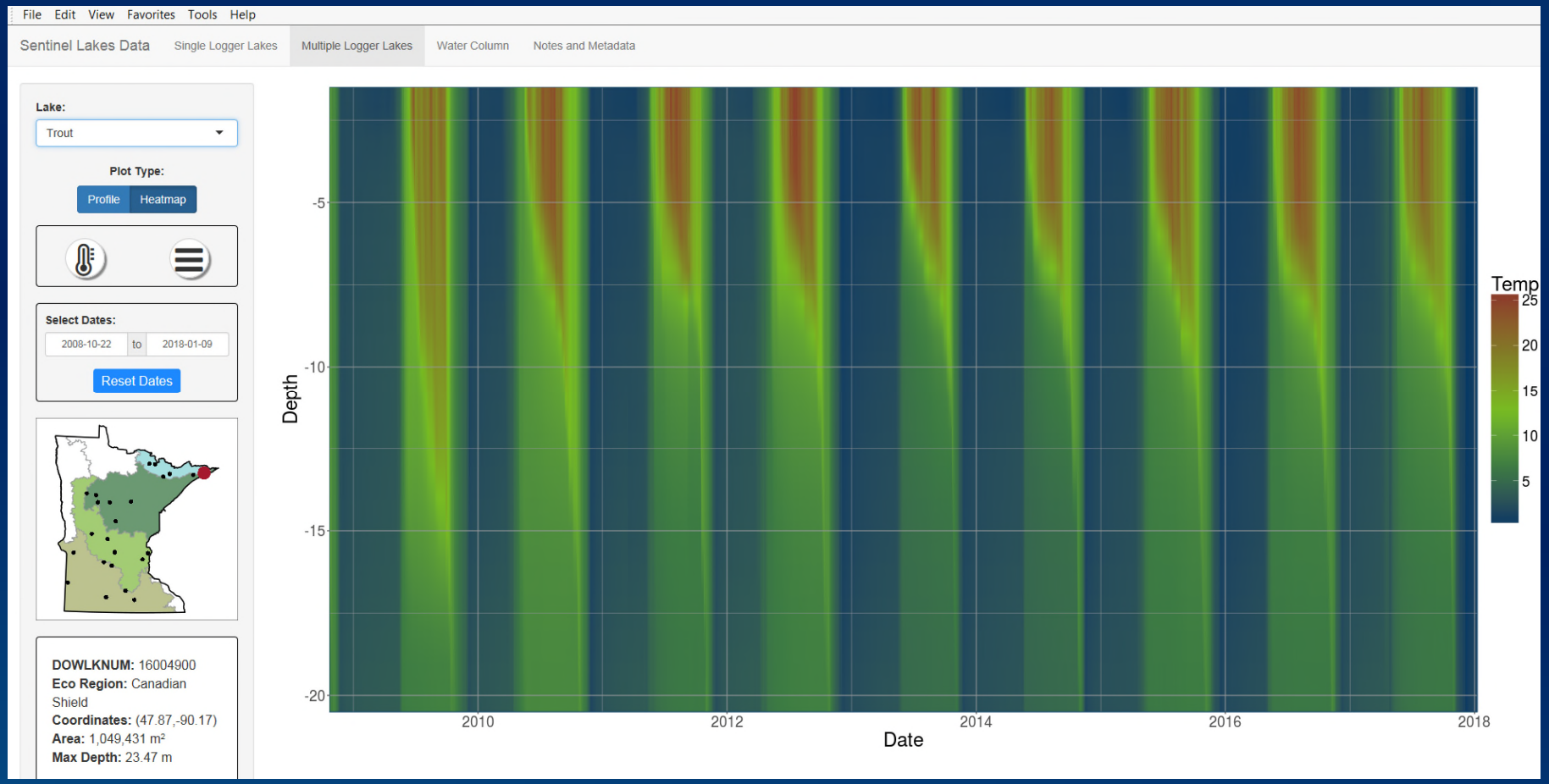
DISSOLVED OXYGEN CHAIN EXAMPLE



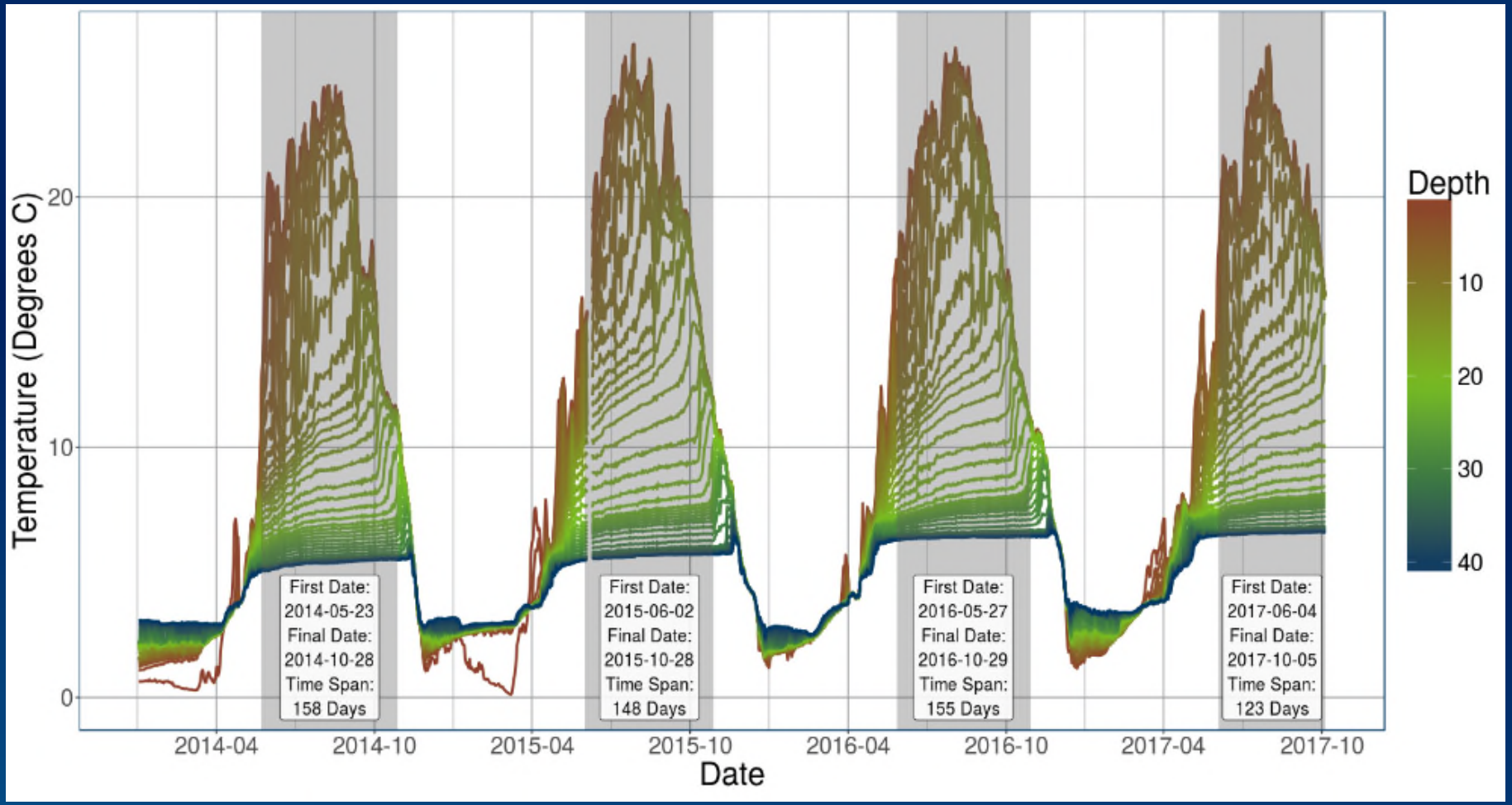
LESSONS LEARNED CHAIN SETUP

- Rope - polyester such as Dacron wears better than nylon and polypropylene and is strong with little stretch (recommended)
- Floats – closed cell foam, label with sticker, paint top black, submerge underwater, back up float, big loop
- Retrieval during winter has worked well, use side scan sonar and under water camera
- Key data points – distance last sensor is from bottom and depth during sampling visits - sounding chain
- Take profiles during sampling visits

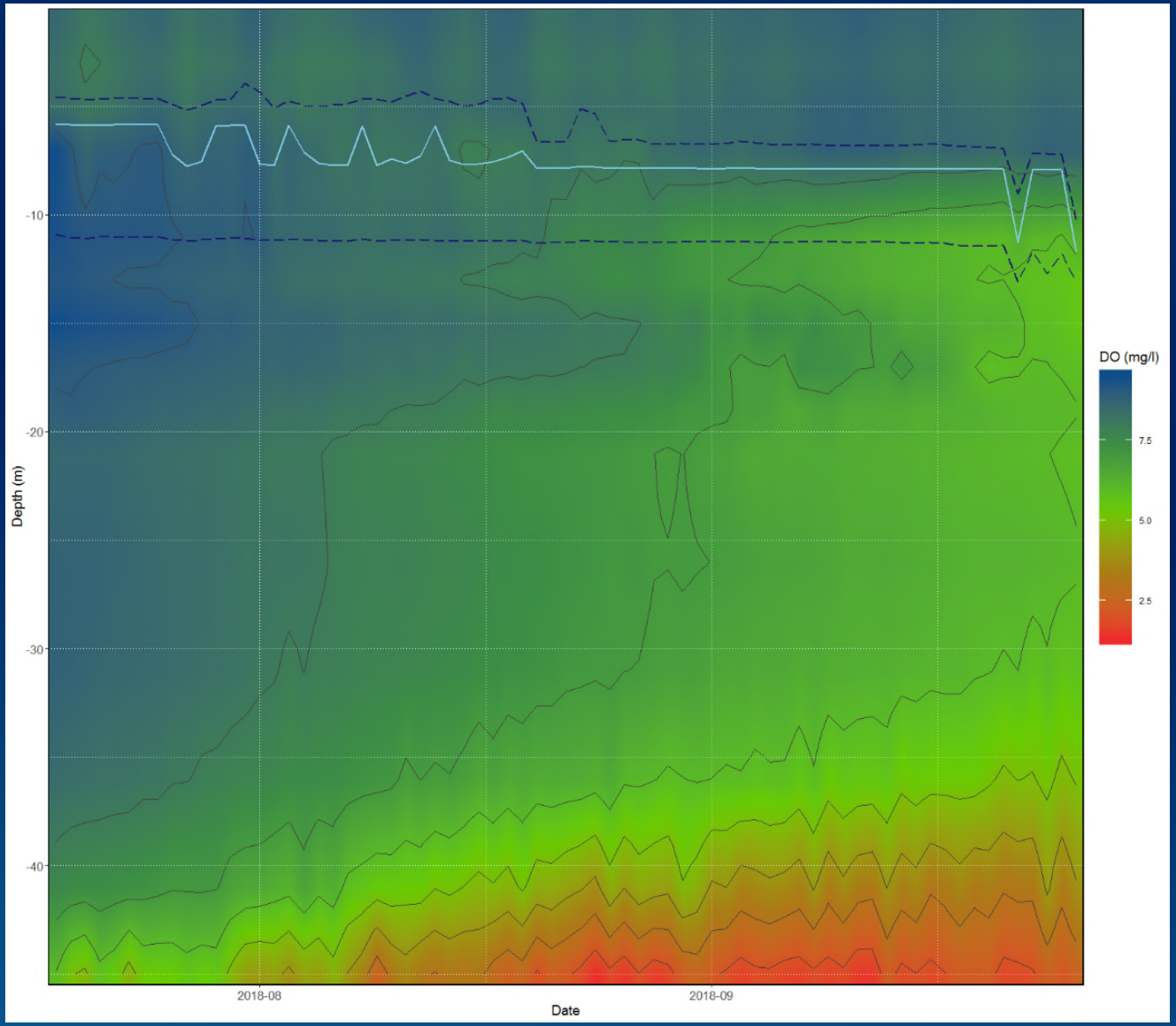
DATA ANALYSIS - TEMPERATURE



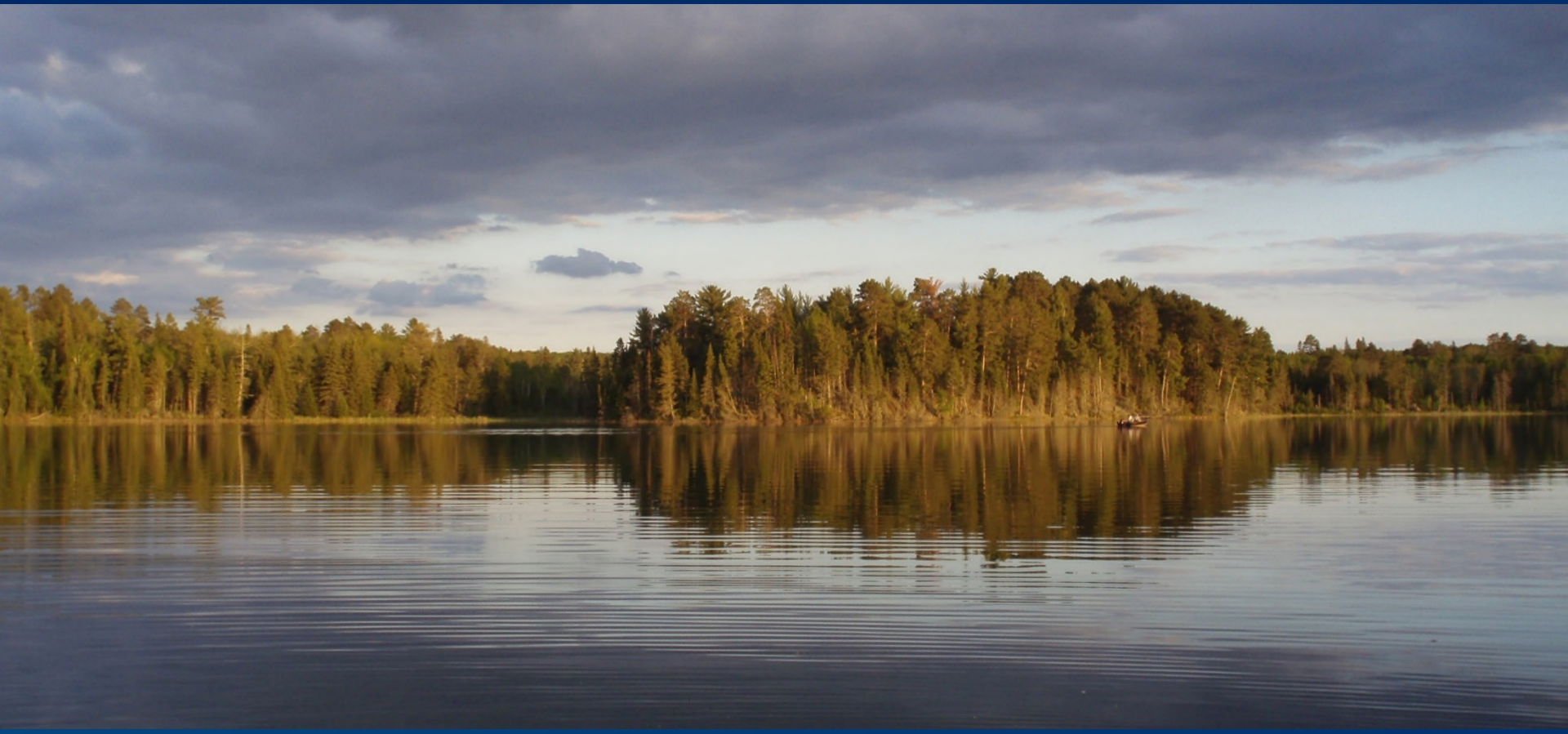
DATA ANALYSIS – # OF DAYS STRATIFIED



DATA ANALYSIS – DISSOLVED OXYGEN



QUESTIONS



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